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Baculites ovatus Say, 1820, a North American ammonite from the Maastrichtian of Roquefort, Landes, France

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With 2 figures

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Abstract: *Baculites ovatus*, Say, 1820, a distinctive baculite previously known only from the condensed Upper Campanian-Lower Maastrichtian phosphatic nodule bed at the base of the Navesink Formation in New Jersey, U.S.A., is described from the Maastrichtian Calcaire à *Orbitoides* of Roquefort, Landes, France. It adds to the growing number of Upper Campanian and Maastrichtian ammonites, many thought previously to be endemic to North America, that occur on both sides of the North Atlantic.

Zusammenfassung: *Baculites ovatus* ist ein charakteristischer Bakulit, der bisher nur aus der kondensierten Phosphoritknollen-Lage der Navesink-Formation in New Jersey (Obercampan-Untermaastricht) bekannt war. Er wird hier aus dem Calcaire à *Orbitoides* von Roquefort, Landes, Frankreich (Maastricht) beschrieben. Er gehört zu einer wachsenden Zahl von Ammoniten des Obercampan und des Maastricht, die bisher als endemisch für Nordamerika angesehen wurden, nun aber für beide Seiten des Atlantiks nachgewiesen werden können.

Introduction

Revision of Campanian and Maastrichtian ammonite faunas from the Atlantic Seaboard and Gulf Coast areas of the United States and the Aquitaine Basin and adjacent areas in S.W. France has revealed a small but

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increasing number of species that are common to the two areas. With the current move to designate a Global Standard Stratotype Section and Point for the base of the Maastrichtian stage at Tercis, Landes, France, based on the first occurrence of the ammonite *Pachydiscus* (*P.*) *neubergicus* (HAUER, 1858), these records are of great significance in intercontinental correlation of the boundary interval. They include the following:

- *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872), Upper Campanian of Texas, U.S.A. (COBBAN & KENNEDY, 1992), and northern Aquitaine (KENNEDY, 1986).

- *Nostoceras hyatti* STEPHENSON, 1941, which occurs widely in the Upper Campanian of the Gulf Coast and Atlantic Seaboard of the U.S. (KENNEDY & COBBAN, 1993a, 1994a), Maurens (Dordogne: KENNEDY, 1986), and Tercis (Landes: HANCOCK & KENNEDY, 1993; WARD & ORR, 1997).

- *Pachydiscus* (*P.*) *jacquoti jacquoti* (SEUNES, 1890), Maastrichtian of Alabama, U.S.A. (COBBAN & KENNEDY, 1995), and the Biscay region (WARD & KENNEDY, 1993).

- *Pachydiscus* (*P.*) *neubergicus neubergicus* (HAUER, 1858), Maastrichtian of New Jersey (KENNEDY et al., 1995) and the Biscay Region (WARD & KENNEDY, 1993).

Pachydiscus (*P.*) *gollevillensis* (D'ORBIGNY, 1850), Maastrichtian of Alabama, U.S.A. (COBBAN & KENNEDY, 1995) and the Biscay region (WARD & KENNEDY, 1993).

- *Nostoceras* (*N.*) *helicinum* (SHUMARD, 1861), which occurs widely in the U.S. Gulf Coast and Atlantic Seaboard (KENNEDY & COBBAN, 1993a) and Tercis (Landes: HANCOCK & KENNEDY, 1993; WARD & ORR, 1997).

- *Trachyscaphites pulcherrimus* (ROEMER, 1841), Upper Campanian of Texas and New Jersey, U.S.A. (KENNEDY & COBBAN, 1994b), northern Aquitaine (KENNEDY, 1986a) and Tercis (Landes: A.S. GALE Collection).

- *Hoploscaphites pumilus* (STEPHENSON, 1941), Upper Campanian (? and lowest Maastrichtian), widespread in the U.S. Gulf Coast and Atlantic Seaboard (KENNEDY & COBBAN, 1993a), Paillon (Haute-Garonne: KENNEDY et al., 1986).

- *Eubaculites carinatus* (MORTON, 1834), widespread in the Maastrichtian of the U.S. Gulf Coast and Atlantic Seaboard (COBBAN & KENNEDY, 1995), the Biscay region (WARD & KENNEDY, 1993), Hautes-Pyrénées and Haute-Garonne (KENNEDY et al., 1986).

- *Didymoceras stephensoni* (WHITFIELD, 1877), from Delaware, U.S.A. (KENNEDY & COBBAN, 1997) and the Pas de Gasaille (Ariège: KENNEDY & BILOTTE, 1995).

The purpose of the present note is to expand this group of intercontinental trans-Atlantic links with a record of the distinctive heteromorph ammonite *Baculites ovatus* SAY, 1820, from the Maastrichtian Calcaire à *Orbitoides* of the Carrière du Cros, Roquefort, Landes, France.

The Cretaceous sequence and faunas in the Roquefort Inlier were first described by RAULIN (1854, 1862). Subsequent accounts are those of

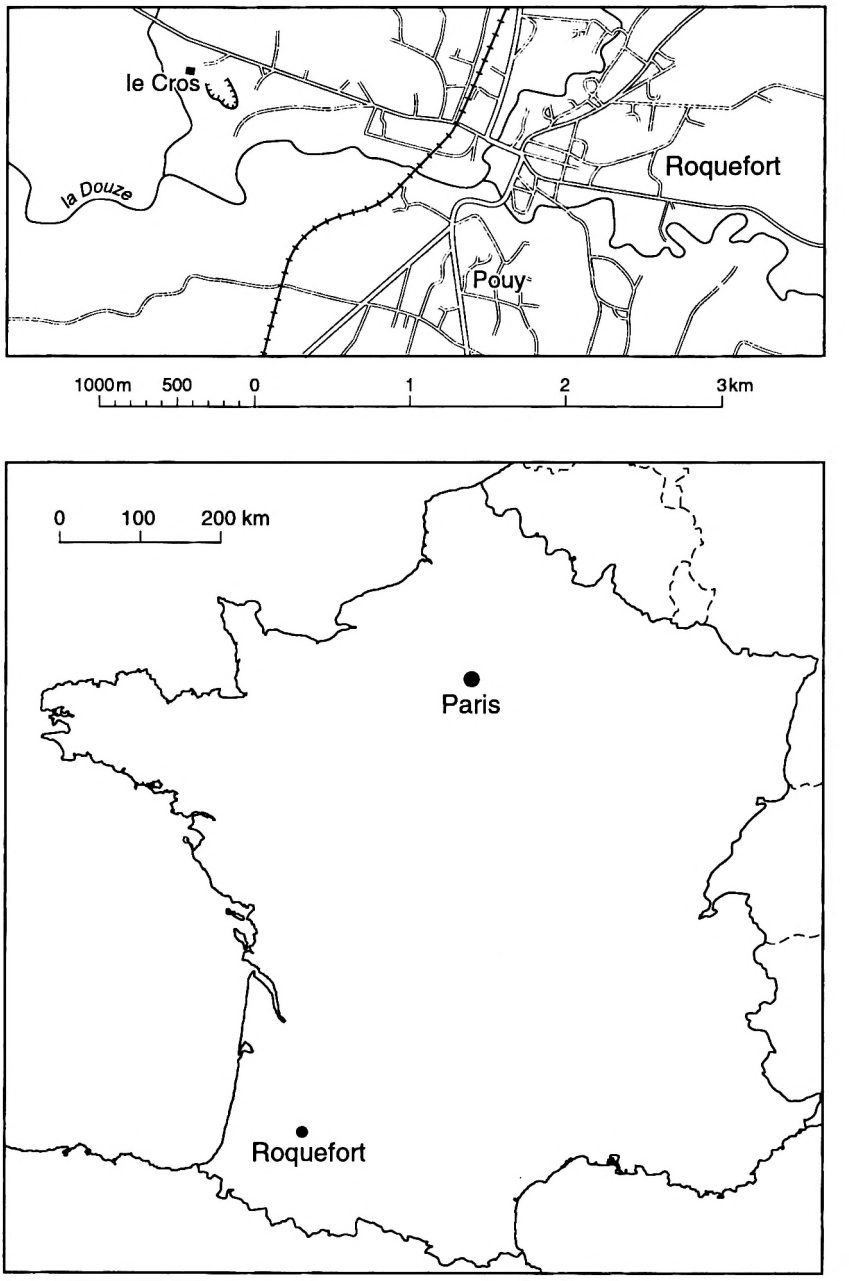

Fig. 1. Sketch map showing the position of Roquefort (Landes) and the Carrière du Cros in S.W. France.

JACQUOT & RAULIN (1874-1897), HÉBERT (1880, 1886), DOUVILLÉ (1902), ASTRE (1923), NEUMANN & CUVILLIER (1950), CUVILLIER et al. (1951), CUVILLIER (1955), NEUMANN (1958), SAINT MARC (1965), BLANC (1973), VAN GORSEL (1975), and VILLAIN (1975). The predominantly carbonate sequence includes rocks of Cenomanian, Turonian, 'Senonian', Campanian and Maastrichtian age, overlain unconformably by Palaeocene sediments.

The Maastrichtian Calcaire à *Orbitoides* is 50 m - 60 m thick according to the second edition of the 1:80,000 Montréal Sheet (1965).

The Carrière du Cros, to the west of Roquefort (Fig. 1) exposes a 12 m face of Cretaceous limestones: lithologies range from cross-bedded calcarenites and calcirudites with shell beds to nodular, bioturbated bioclastic limestone with incipient and fully developed hardgrounds with empty *Thalassinoides* burrows, the walls sometimes glauconitised. Rudistid bivalves, scleractinian corals, sclerosponges, algae, and bryozoans are common: larger benthic foraminifera are abundant, and are listed below.

The Cretaceous sequence is terminated by a prominent hardground and unconformity, the surface worn smooth, bored by lithodomous bivalves, and overlain by a thin pebble bed of bored limestone and other clasts. Up to 2 m of Tertiary carbonates are present above the unconformity.

Systematic Palaeontology

Family Baculitidae GILL, 1871
Genus *Baculites* LAMARCK, 1799

Type species: *Baculites vertebralis* LAMARCK, 1801, p. 103, by subsequent designation by MEEK, 1876, p. 391.

Baculites ovatus SAY, 1820 Fig. 2a-e

1820 *Baculites ovatus*. – SAY, p. 41.
1974 *Baculites ovatus* SAY. – COBBAN, p. 3, pl. 1, figs. 1-32; pl. 2, figs. 1-14; pl. 3, figs. 1-6, 9-11; text-fig. 34 (with full synonymy).

Fig. 2. *Baculites ovatus* SAY, 1820. a-c, original of COBBAN, 1974, pl. 3, figs. 9-14, from the condensed phosphatic Upper Campanian-Lower Maastrichtian fauna at the base of the Navesink Formation at Atlantic Highlands, New Jersey. d-f, Université Paul Sabatier, Toulouse, Collections of the Laboratoire de Géologie Sédimentaire et Paléontologie, no. UPST-COUZ-01 (ex COUZEFEYTE Collection), from the Maastrichtian Calcaire à *Orbitoides* of the Carrière du Cros, Roquefort, Landes, France. All figures are x 1.

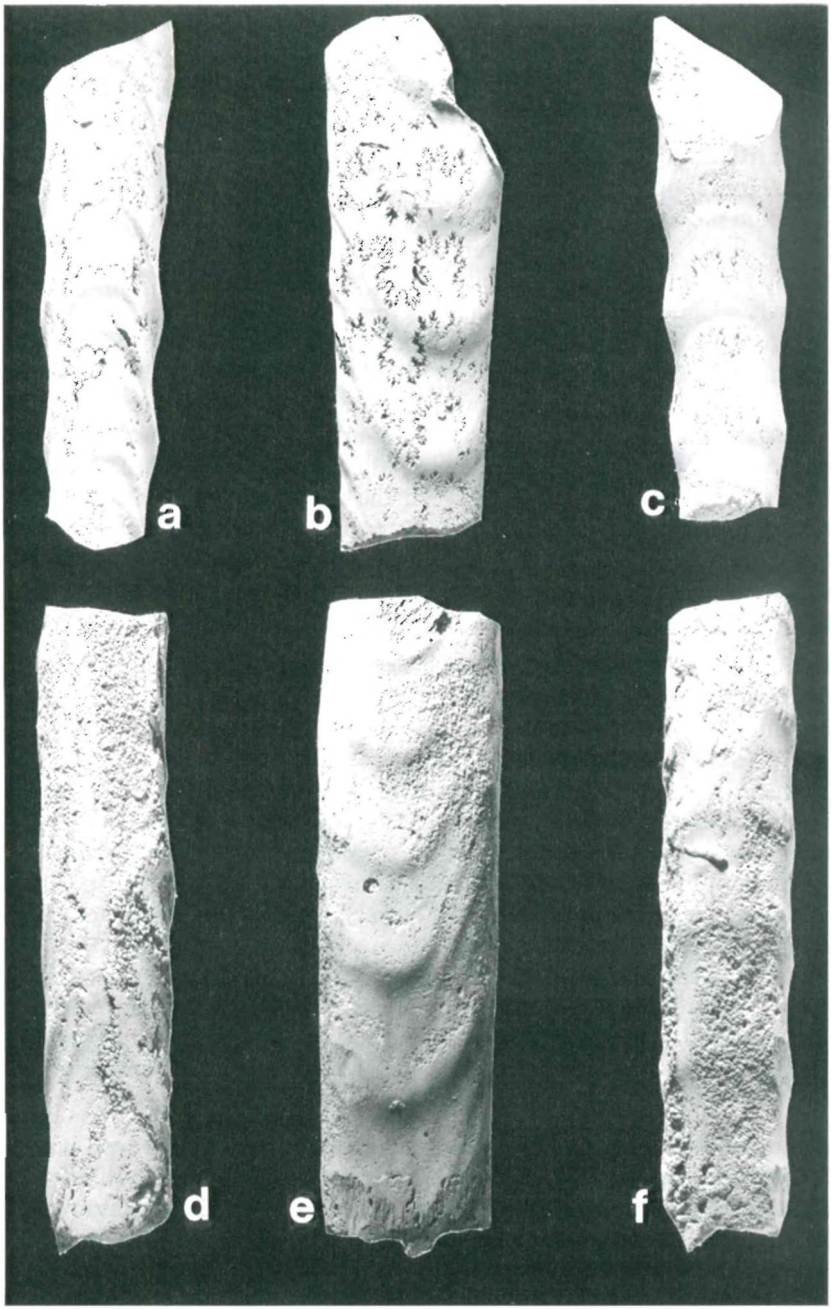

Fig. 2 (Legende see p. 162)

1995 *Baculites ovatus* SAY. – KENNEDY, JOHNSON & COBBAN, p. 7, pl. 6, figs. 13-15.

Type: The type material appears to be lost (COBBAN, 1974, p. 4); it was from the Navesink Hills in Monmouth County, New Jersey.

Description: UPST-COUZ-01 (ex COUZEFEYTE Collection (Fig. 2d-f) is an 88.9 mm long fragment from the adapical end of a body chamber with a maximum preserved whorl height of 27.5 mm, and a whorl breadth to height ratio of 0.72. The dorsum is very feebly convex, the dorsolateral margin broadly rounded, the flanks feebly convex, and the venter only slightly more narrowly rounded than the dorsum. There are two primary ribs in a distance equal to the whorl height. They are broad, low and feebly convex across the dorsum (Fig. 2e), strengthen across the dorsolateral margin, and are transverse, crescentic and concave towards the aperture on the dorsal 60 % of the flank. They project strongly forwards and decline into narrow strongly prorsiradiate ribs on the ventral flanks, where one or more similarly narrow intercalated ribs are inserted between the attenuated primaries, and may branch, all ribs crossing the venter in a broadly rounded linguoid peak, convex towards the aperture (Fig. 2d). Parts of the final chamber and septum are preserved; the latter has a poorly preserved, moderately incised E/L, L, and L/U; E is broad with a wide low external saddle.

Discussion: The present specimen has the same style of ornament, and whorl section as material figured by COBBAN (1974) from the Navesink Formation of New Jersey, as can be seen from a comparison of Figs. 2a-c and 2d-f.

When compared with other well-known European species. *Baculites vertebralis* LAMARCK, 1801 (see revisions in KENNEDY, 1986, 1987) has an oval rather than ovoid whorl section, and is typically very feebly ornamented, with growth lines, striae and fine riblets only. Occasional ribbed specimens have more irregular ornament than *B. ovatus*, and may be constricted. *Baculites anceps* LAMARCK, 1822 (see revisions in KENNEDY, 1986b, 1987) has an utterly distinctive tear-shaped cross section with acute venter flanked by shallow grooves. *Baculites leopoliensis* NOWAK, 1908 (see revision in KENNEDY et al., 1986, and HANCOCK & KENNEDY, 1993) has strong primary ribs that are much closer spaced than in *B. ovatus*, and lacks the distinctive narrow primary plus intercalated ribs on the outer flank and venter.

Age and Occurrence: The provenance of the now missing type material of *Baculites ovatus* is discussed in detail by COBBAN (1974), who demonstrated that the only known previous occurrence of the species was as phosphatised individuals in the basal nodule bed of the Navesink Formation at Atlantic Highlands and elsewhere in New Jersey.

At Atlantic Highlands, the associated phosphatic fauna in the nodule bed is made up of four elements (KENNEDY et al., 2000):

1. Ammonites that are restricted to the Upper Campanian *Nostoceras hyatti* Zone in expanded successions elsewhere in the U.S. Gulf Coast and Atlantic Seaboard (e.g. KENNEDY & COBBAN, 1993a, b; COBBAN & KENNEDY, 1994a) and Europe (HANCOCK & KENNEDY, 1993; WARD & ORR, 1997): these include *N. hyatti* STEPHENSON, 1941, *N. approximans* (CONRAD, 1855), *N. pauper* (WHITFIELD, 1892), *Cirroceras conradi* (MORTON, 1841), and *Jeletzkytes nodosus* (OWEN, 1852).

2. Those that occur in both the Upper Campanian and Lower Maastrichtian in expanded sequences: *Pseudophyllites indra* (FORBES, 1846), *Baculites claviformis* STEPHENSON, 1941, and *Hoploscaphites pumilus* (STEPHENSON, 1941).

3. Those that are exclusively Maastrichtian: *Nostoceras mendryki* COBBAN, 1974, *Pachydiscus* (*P.*) *neubergicus* (HAUER, 1858).

4. Those that cannot be assigned to one or other stage with confidence: *Kitchinites* sp., *Nostoceras pauper* (WHITFIELD, 1892), *N.* aff. *obtusum* HOWARTH, 1965, *Exiteloceras* sp. nov., *Axonoceras* cf. *angolanum* HAAS, 1943, and *Baculites ovatus* SAY, 1820.

That *Baculites ovatus* occurs only in the basal Navesink Formation in the U.S. suggests that it may be Lower Maastrichtian or uppermost Campanian-Lower Maastrichtian rather than exclusively Campanian.

In France, the present specimen of *Baculites ovatus* comes from Carrière du Cros at Roquefort (Landes).

We examined a thin section of this specimen; the matrix includes the larger benthic foraminifera *Orbitoides* sp. group of *apiculata* SCHLUMBERGER, and *Siderolites* aff. *calcitrapoides* LAMARCK. We also examined thin sections of samples from the 12 metres of nodular, bioclastic, cross-bedded and burrowed carbonate sequence exposed in the Carrière du Cros in 1988. The following larger foraminifera were recognized: *Siderolites* (*S.*) *calcitrapoides* LAMARCK, *Siderolites* (*Pseudosiderolites*), gr. *vidali* DOUVILLÉ, *Lepidorbitoides socialis* (LEYMERIE), *L.* aff. *socialis*, *L.* aff. *minor* SCHLUMBERGER, *Lepidorbitoides* sp., *Orbitoides apiculata* SCHLUMBERGER, *O.* aff. *gensacicus*, *Fallotia jacquoti* DOUVILLÉ. *Planorbulina cretae* (MARSSON), *Minouxia* sp., *M.* cf. *lobata* GENDROT, *Abrardia mosae* (HOFKER), *Bonetocardiella* aff. *maestrichtiensis* (VISSER), *Omphalocyclus macroporus* LAMARCK, *Nummofallotia cretacea* (SCHLUMBERGER), and *Praestorrsella roestae* (VISSER).

This is a Maastrichtian assemblage on the basis of the work of NEUMANN & CUVILLIER (1950), VAN GORSEL (1973) on the *Helicorbitoides-Lepidorbitoides* lineage, and data summarised in BILOTTE (1985, 1988), but because we do not know the exact position of *Baculites ovatus* in the Carrière du Cros sequence, and because of difficulties of correlation between larger benthic

foram assemblages and the ammonite-defined zonation of the Maastrichtian, we are unable to place the Roquefort occurrence within Lower versus Upper Maastrichtian substages.

Confirmation of the Maastrichtian age of the Calcaire à *Orbitoides* comes from the presence of a second *Baculites* in the sequence. UPST-COUZ-02 is a 50 mm long fragment of body chamber with a maximum preserved whorl height of 13.7 mm. The whorl sections is tear-shaped, the whorl breadth to height ratio is 0.68. The dorsum is flattened, the dorsolateral region broadly rounded, dorsal flanks feebly convex, ventral flanks convergent, and venter more narrowly rounded than dorsum. Ornament is poorly preserved; there are two widely separated, coarse, concave crescentic ribs on the dorsal half of the flank, that project strongly forwards, decline and efface on the ventral half of the flanks. On the basis of the distinctive whorl section and ornament, this specimen can be assigned to *Baculites anceps* LAMARCK, 1822 (see revisions in HOWARTH, 1965 and KENNEDY, 1986b). This species is restricted to the Maastrichtian stage, and is best known from the Upper Maastrichtian.

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